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CHEMICAL & ENGINEERING NEWS

C&EN

NOVEMBER 22, 1993

ACADEMIC CHEMISTS BEGIN TO DEFINE RESEARCH ETHICS STANDARDS PAGE 24

FULLERENE COMMERCIALIZATION

Ideas abound, but products slow to develop

Page 8

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CHEMICAL & ENGINEERING NEWS

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NOVEMBER 22, 1993

NEWS OF THE WEEK

- Chemical industry hails NAFTA passage by House of Representatives, expects strong growth in chemical exports to Mexico. **Page 4**
- Chemists at MIT synthesize a biodegradable copolymer that potentially could serve as a tissue matrix in the human body. **Page 5**
- Senate report berates EPA's failure to reduce toxic air emissions and smog; new EPA official pledges to do better. **Page 5**
- Winner of ACS presidential election is Brian M. Rushton, defeating Hank Whalen by more than 4,000 votes. **Page 6**
- Baxter International, maker and marketer of health care products, announces massive, costly reorganization that may eliminate 4,500 jobs. **Page 7**

BUSINESS

Profitability is up for U.S. ethylene producers this year, but prospects of higher feedstocks costs and potential excess supply dampen outlook for 1994. **Page 21**

GOVERNMENT

Many chemists have observed scientific misconduct and other dubious research practices, but chemistry departments don't see a need for formal ethics training, a recent study shows. **Page 24**

Politics have played a role in prosecution of environmental criminal cases, with the U.S. Attorney General's office usurping local authority, witnesses charge at a House hearing. **Page 26**

SCIENCE/TECHNOLOGY

Operation of an international space station staffed by scientists from the U.S., Russia, and other countries may be a reality in 2001, if the White House approves submitted plans. **Page 29**

Guidelines for evaluating in-situ bioremediation projects are proposed by a National Research Council committee. **Page 30**

Breakneck pace of NFS's first materials chemistry workshop invigorates some attendees, disappoints others. **Page 33**

Novel crystalline carbon networks that can collapse in two directions are postulated by scientists' calculations. **Page 35**

BOOKS

"Murder, Magic, and Medicine" explores links between folk medicine and modern drugs in a delightful foray into one special aspect of the heritage of chemistry. **Page 36**

NEWS FOCUS

Although the unique physical and chemical properties of fullerenes and their derivatives continue to fuel speculation on possible uses, commercial markets for these compounds have been slow to develop. Page 8

LETTERS 2
EDITOR'S PAGE 3
CONCENTRATES
Business 19
Government 23
Science/Technology 28
THE DEPARTMENTS
Federal Alert 27
ACS Comment 38
Newscripts 52

COVER: Ronald Ziolo, senior scientist at Xerox Webster Research Center, Webster, N.Y., examines a flask containing a solution of C_{60}; the flask with amber-colored liquid contains a solution of C_{70}.

Volume 71, Number 47
CENEAR 71 (47) 1–52
ISSN 0009-2347

Chemical & Engineering News
1155—16th St., N.W., Washington, D.C. 20036
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Published by
AMERICAN CHEMICAL SOCIETY
(202) 872-4600; TDD (202) 872-4432
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Subscription Rates 1993: Printed editions: nonmembers U.S. 1 yr. $110, 2 yr. $198; outside U.S. 1 yr. $148, 2 yr. $274. Air freight rates available on request. Rates above do not apply to nonmember subscribers in Japan, who must enter subscription orders with Maruzen Co. Ltd., 3-10 Nihonbashi 2-chome, Chuo-ku, Tokyo 103, Japan. Tel: (03) 272-7211. Single copies: Current $18. Rates for back issues and volumes are available from Microforms & Back Issues Office, ACS, 1155—16th St., N.W., Washington, D.C. 20036. Back and current issues available on microfilm and microfiche. Rates on request from Microform Program, ACS.

Chemical & Engineering News (ISSN 0009-2347) is published weekly except for the last week in December by the American Chemical Society at 1155—16th St., N.W., Washington, D.C. 20036. Second-class postage paid at Washington, D.C., and additional mailing offices. POSTMASTER: Send address changes to Chemical & Engineering News, Membership & Subscription Services, P.O. Box 3337, Columbus, Ohio 43210. ACS assumes no responsibility for the statements and opinions advanced by the contributors to its publications.

Advertising Management: CENTCOM LTD.
(For list of offices see page 79)
Office of Ombudsman: (800) ACS-5558, No. 5-4
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LETTERS

Mistaken identity

We wish to correct the reference to Knute Rockne described in John Meisenheimer's letter (C&EN, Oct. 25, page 2). Indeed, Rockne was a chemist as well as a football coach and he was well acquainted with Father Nieuwland, who developed vinylacetylene and chloroprene, the forerunners of neoprene. However, the archival picture in C&EN and referenced by Meisenheimer as demonstrating that Rockne was a chemist is not a picture of Rockne.

As we pointed out in a letter to the editor more than 10 years ago when the picture first appeared in C&EN (Sept. 28, 1981, page 44), the person in the archival picture and purported to be Knute Rockne in J. A. Nieuwland's laboratory at Notre Dame is in fact J. P. Young, our father, who graduated from Notre Dame in 1908. Various details in the picture, particularly the style of Nieuwland's biretta and the view of the terrain as seen through the windows, indicate that the photograph was taken around 1906, prior to Rockne's time at Notre Dame.

This has been confirmed by the Notre Dame archives office.

Jack P. Young
Oak Ridge, Tenn.
Jay A. Young
Silver Spring, Md.

NIST director Arati Prabhakar

I commend President Bill Clinton for choosing and Congress for confirming Arati Prabhakar as director of the National Institute of Standards & Technology (NIST) (C&EN, Sept. 6, page 19). Craig Fields was absolutely correct in recommending Prabhakar to replace John W. Lyons. The time is right to show the world that women and minorities are qualified to shape the U.S. and the world in the 21st century. Prabhakar has both imagination and flexibility, perhaps the most important attributes of a successful engineer, scientist, or policy shaper. We need people like her today.

One of the areas in which she can help the U.S. is by bridging the trade gap with Japan. Biomedical/biochemical engineering is the high technology of the future. Advances in this field will help to reduce health care costs, a major aim of the Clinton Administration.

To meet the challenge for global competitiveness, the U.S. must educate more people in high-technology disciplines. Space-age technologies must be brought into the mainstream. Because there is no longer any threat to the U.S. from the former Soviet Union, research on lasers, for example, can focus on biomedical applications.

NIST should not only look at the use of the latest materials in sporting goods, but also at their application in medical science. Technology, biotechnology, and biomedical engineering should be used to create national wealth—including brain power, the first and foremost national asset. The many unemployed engineers from defense-related industries are the superpowers of the earlier technological muscle power of the U.S. They could help to create the national wealth. I believe Prabhakar can play a key role in achieving this.

There is undue concern from NIST's staff regarding the appointment of a woman director and about the changes that will take place within NIST. Human beings never like change; however, change is a must in this day and age. When the late Indira Gandhi was appointed prime minister of India, similar concerns were voiced by politicians outside her party who doubted her ability to handle the premiership.

Harcharan Singh Ranu
Greenvale, N.Y.

Reminder to members

In accordance with an ACS policy on a grace period for unrenewed ACS journals and C&EN, ACS cannot continue to send C&EN and journals after Feb. 28, 1994, to those members whose 1994 dues and subscriptions are not received by Feb. 1. If you have questions about your dues bill or wish to charge your payment by phone, call (800) 333-9511 or (614) 447-3600 in the Columbus, Ohio, area. Be sure to have your credit card handy if you plan to charge your payment.

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U.S. Ethylene Producers Ending 1993 With Higher Profitability

■ ***But major chemical faces tough time next year as higher feedstock costs, potential oversupply may cut into bottom line***

Susan J. Ainsworth, C&EN Houston

On a global scale, 1993 has been a poor year for producers of ethylene. However, during the past year, domestic ethylene makers have made considerable progress toward solving some of the problems that have plagued them during the past couple of years of industry downturn.

The best news, perhaps, is that U.S. ethylene producers have enjoyed higher profit margins compared with 1992, thanks mostly to lower raw materials costs this year. In addition, ethylene demand is gaining momentum. Ethylene, one of the largest volume commodity chemicals produced worldwide, is used as a raw material to make plastics, fibers, and other organic chemicals that are ultimately consumed in the packaging, transportation, and construction industries, and in many other industrial and consumer markets.

Ethylene's demand is extremely sensitive to economic cycles. For example, as the U.S. economy has strengthened, so has domestic demand for polyethylene, the largest market for ethylene.

Another bright spot: Over the past year, producers have been more careful in synchronizing ethylene capacity additions with demand growth. As a result, U.S. ethylene producers are benefiting from higher plant operating rates, which are now averaging about 90% of capacity.

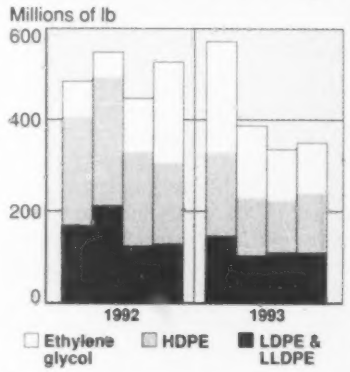
However, these improvements don't yet signal the beginning of an upturn. Between early 1994 and early 1995, four producers are poised to complete expansions that will bring a total of 4.0 billion lb of ethylene capacity onto the market. That wave of additional annual capacity likely will bring operating rates back to 85% or so of capacity, which "is no better than where rates were at the bottoming out point [of the current downturn] in the spring of 1992," observes William L. Urquhart, a senior consultant with Houston-based Pace Consultants. "So in 1994, ethylene producers probably will find themselves bouncing along the bottom of [the trough] again."

With the potential for greater oversupply on the horizon, ethylene producers' chief concern now is "how demand for ethylene derivatives will shake out in the coming year," says Urquhart. With several new plants for polyethylene and ethylene glycol coming on stream worldwide in 1994, ethylene producers are hoping that consumption will remain high enough to keep those plants running at respectable rates, thereby buoying demand for ethylene.

Ethylene demand, as always, will dip in December as producers of ethylene derivatives draw on stocks of their products at year's end, says Urquhart. "But early signals indicate that demand for derivatives looks pretty good into the early months of the new year." A market manager for one ethylene producer says, "We believe U.S. ethylene consumption will grow 2 to 3% in the near term, which, historically speaking, is not weak demand." Demand in 1993 grew at only about 1.7% over 1992, according to Urquhart.

Indeed, domestic demand for polyethylene has been on the rise for the past few months. For the year through August, domestic sales and captive use (excluding imports and exports) of linear low-density polyethylene (LLDPE) was up 5.7% over the same period in 1992 to reach 3.51 billion lb, based on the latest monthly statistical figures from the Society of the Plastics Industry. During that same period, domestic sales and captive use of high-density polyethylene (HDPE) rose 4.9% to 6.28 billion lb. However, domestic sales and captive use of low-density polyethylene (LDPE) dropped 2.7% in the January through August period of 1993 from the same period in 1992 to total 4.13 billion lb. "In this country," says Urquhart, "we are really fortunate that demand is holding up."

Net exports of key ethylene derivatives slip



Note: Net exports represent exports minus imports. Quarterly data; third-quarter and fourth-quarter 1993 are estimates. **Source:** Pace Consultants

The export picture, however, has not been as pretty. "Fifteen months ago, we witnessed a tremendous falloff in exports of derivatives, which coincides with poor economic conditions in many traditional export countries and the startup of competitive polymer plants in the Far East," says Urquhart. For example, according to Pace's forecast based partly on preliminary government data, it appears that net exports (exports minus imports) of ethylene glycol dropped about 9% to 105 million lb in the third quarter of 1993 compared with the same quarter last year. Similarly, over the same period, net exports of HDPE probably fell about 40% to 120 million lb and combined net exports of LDPE and LLDPE likely dropped about 13% to 110 million lb.

On the supply side, Formosa Plastics, a wholly owned subsidiary of Formosa Plastics Group, Taiwan, is slated to be the first of four producers to com-

plete significant capacity additions between 1994 and early 1995. Formosa's plant is part of a $1.3 billion expansion at Point Comfort, Tex., that will add capacity for LLDPE, HDPE, ethylene glycol, polypropylene, and chlor-alkalies, as well as olefins. The company is currently in the shakedown stage of construction of the ethylene unit, which will have a capacity of 1.5 billion lb per year. Formosa has not yet determined when the plant will be ready for startup. Some observers speculate that the plant will begin production sometime during the first quarter of the new year, while others say a startup is imminent.

Formosa confirms that it will hold off startup of its olefins unit until its derivatives units are up and running smoothly on purchased ethylene. One holdup in that plan is the rebuilding of an incinerator that caught fire late last month in the new HDPE unit while the company was completing preoperational testing.

In another move, in the second half of 1994 Amoco Chemical will expand its capacity at Chocolate Bayou, Tex., by 550 million lb per year. In addition, Exxon Chemical plans to increase the ethylene capacity of its Baytown, Tex., olefins plant by 450 million lb per year late next year. This will raise the capacity of this facility, already the world's largest single train ethylene plant, to 2.5 billion lb per year. "This expansion is planned to meet the expected growth in ethylene demand from both our external customers and internal requirements," says Sherman J. Glass Jr., vice president of the Basic Chemicals Americas unit of Exxon Chemical. Earlier this year, Exxon expanded its ethylene cracker at Baton Rouge by 175 million lb per year.

Meanwhile, Dow Chemical is expected to finally start up a 1.5 billion-lb-per-year ethylene plant at Freeport, Tex., during first-quarter 1995. However, Dow may idle some of its existing capacity when the new plant is up and running; the company has facilities with about 700 million lb of capacity along the Gulf Coast that are nearly 30 years old. The decision as to whether it will shut down all or just some of that old capacity will be based on market conditions and demand requirements in early 1995, Dow says.

Although producers have been more careful in timing large increases in capacity to coincide with demand growth, production still continues to climb and is projected to break a record for 1993. For the year through the third quarter, production was up 2.7% over the comparable period in 1992, totaling 31.4 billion lb, according to figures released earlier this month from the National Petroleum Refiners Association (NPRA). Pace estimates that full-year production will reach 42 billion lb, up 1.3% from 1992.

NPRA inventory figures for the third quarter show more notable change over the same period last year. The past quarter's ethylene inventories are up 50% from third-quarter inventories in 1992. "Though inventories are up sharply versus a year ago, they are ample, not excessive," says Urquhart. "At 1.84 billion lb, stocks represent 16 days' demand inventory—ample and comfortable, and tending to the long side of the range of recent years, but only barely."

With supply and inventories being more than adequate for meeting market demand, it's not surprising that producers have failed in repeated attempts to raise the price of ethylene in 1993. When prices for ethylene raw materials rose in April, producers responded by announcing a 1 cent-per-lb ethylene price increase, effective May 1. That attempt failed as competition intensified in ethylene derivatives, and was postponed until June and then until July, when it faltered again.

Although ethylene producers were not able to boost the price of ethylene, their attempts did help to halt a slide in price earlier in the year, says Urquhart, noting that the "official" ethylene price has remained at 21 cents per lb since March. However, beginning in the third quarter, discounts of official prices (which are traditionally given to large volume and other special purchasers) have increased. Two weeks ago, discounting widened even more, lowering the average "transactional" price to below 17.5 cents per lb.

However, even with falling transactional prices, sellers actually have improved their profit margins for ethylene this year, Urquhart observes. Based on ethane feedstock purchased at contract price, Pace estimates that margins for ethylene producers are about 7.6 cents per lb this month, 1 cent higher than a year ago even though the transactional price is 2.5 cents per lb lower than it was then.

Improved profit margins can be attributed to the price of ethane—the major feedstock for ethylene production—which has fallen dramatically over the past several months. Earlier this year, prices for natural gas liquids (NGLs), including ethane, were high, so natural gas processors adjusted their plants to produce more of them. In the course of doing so, processors created an oversupply of NGLs, especially ethane. Inventories have built, peaking in September at 26 million barrels, and prices have dropped about 30% between April and this month, says Michael Horvath Jr., senior consultant, who tracks NGL markets at Houston-based consulting firm Bonner & Moore Associates Inc.

However, natural gas processors began to reject ethane in September, leaving more of this light gas in the natural gas stream. So, beginning this month, NGL prices have begun to firm and are expected to continue to rise into next year, Horvath projects. "But prices are not expected to rise so sharply so as to discourage consumption of ethane, which is expected to exceed 600,000 bbl per day through February of 1994," he adds.

With higher NGL prices on the horizon, ethylene profit margins are not likely to be as strong in 1994 as they've been in 1993. In addition, competition among downstream products is expected to intensify in the coming year, placing downward pressure on profitability, adds Urquhart.

Although ethylene producers do face a number of setbacks in the coming year, some are encouraged by the strides they've made in 1993. They are hoping, too, that a true turnaround is not far off. As one producer points out, except for the Dow startup early in 1995, no other U.S. expansions are planned for 1995 and beyond. □

Four producers plan to add ethylene capacity by early 1995

Company/location	Annual capacity (millions of lb)	Estimated startup date
Formosa Plastics Point Comfort, Tex.	1,500	Early 1994
Amoco Chemical Chocolate Bayou, Tex.	550	Late 1994
Exxon Chemical Baytown, Tex.	450	Late 1994
Dow Chemical Freeport, Tex.	1,500	Early 1995
TOTAL	**4,000**	

Source: Company data